HEI

STATEMENT

Synopsis of Research Report 116

HEALTH EFFECTS INSTITUTE

Biomarkers in Butadiene-Exposed Workers

BACKGROUND

Butadiene is a four-carbon gaseous chemical synthesized for the manufacture of resins, plastics, and synthetic rubber. It is also produced by combustion; butadiene is present in cigarette smoke and emissions from motor vehicles and some stationary sources. The highest exposures, those that occur in occupational settings, may present a health concern because butadiene is known to be carcinogenic in rats and mice and some epidemiologic studies have implicated it as a human carcinogen by inhalation. Those studies have indicated that workers exposed to butadiene in rubber-producing factories also have an increased incidence of two types of cancer: cancers of the lymphatic system and cancers of the organs and systems of the body that produce blood cells. More recent and comprehensive studies of the same workers have indicated an increased risk of leukemia (but not other types of cancers) in workers with a long duration of employment in the rubber industry. On the basis of these epidemiologic studies, various government and international agencies have conducted risk assessments of butadiene's carcinogenicity and designated it as "potentially carcinogenic to humans," "a probable human carcinogen," and a "known human carcinogen."

In 1994, HEI initiated a research program to address the health risks of exposure to a series of chemicals, including butadiene, designated as toxic air pollutants by the US Environmental Protection Agency. In 1995, HEI issued Request for Qualifications 95-3, "Transitional Epidemiology Studies for Benzene or 1,3-Butadiene Biomarkers," which sought researchers with access to human populations exposed to either benzene or butadiene. The goal of RFQ 95-3 was to fund research to determine whether human exposure could be quantified by measuring the levels of certain biomarkers. Biomarkers are chemical compounds or physical characteristics that appear in bodily fluids or tissues after exposure to an exogenous agent. They can be specific indicators of exposure such as stable metabolites, metabolites bound to proteins or DNA, or genetic material that was altered because of the exposure.

Epidemiologic studies have encountered two primary difficulties in assessing exposure to carcinogenic agents. First, because the incidence of certain cancers is low, they have needed to study large populations to find an association between exposure and disease. Second, it is often difficult to accurately assess the level or time course of exposure to a possible cancer-causing agent in order to link past exposures to recent disease occurrences. In contrast with this, populations known to have been exposed to certain chemicals (such as groups of workers in a specific industry) show relatively high levels of biomarkers. Therefore, if biomarkers can accurately reflect the level or timing of exposure to a suspected carcinogen, they may be able to enhance exposure assessment in epidemiologic studies.

Dr Richard Albertini at the University of Vermont in Burlington organized groups of researchers from his own laboratory and laboratories in Galveston, Texas; Chapel Hill, North Carolina; Prague, Czech Republic; Amsterdam and Leiden, The Netherlands; and Sheffield, United Kingdom. Each group had expertise in identifying different biomarkers that appear after butadiene exposure. Dr Radim Šrám of the Laboratory of Genetic Ecotoxicology in Prague provided contact with butadiene-exposed workers in two production units of a factory near Prague.

APPROACH

The researchers proposed to determine whether biomarkers in the blood and urine of the exposed workers correlated with their personal exposure

Continued

This Statement, prepared by the Health Effects Institute, summarizes a research project funded by HEI and conducted by Dr Richard J Albertini at the University of Vermont, Burlington VT, with collaborators in seven European and US institutions. The complete report, *Biomarkers in Czech Workers Exposed to Butadiene: A Transitional Epidemiologic Study*, can be requested from HEI (see reverse side). ALBERTINI 116

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